

# Hydrophobically Modified Dendrimers as Inverse Micelles: Formation of Cylindrical Nanostructures

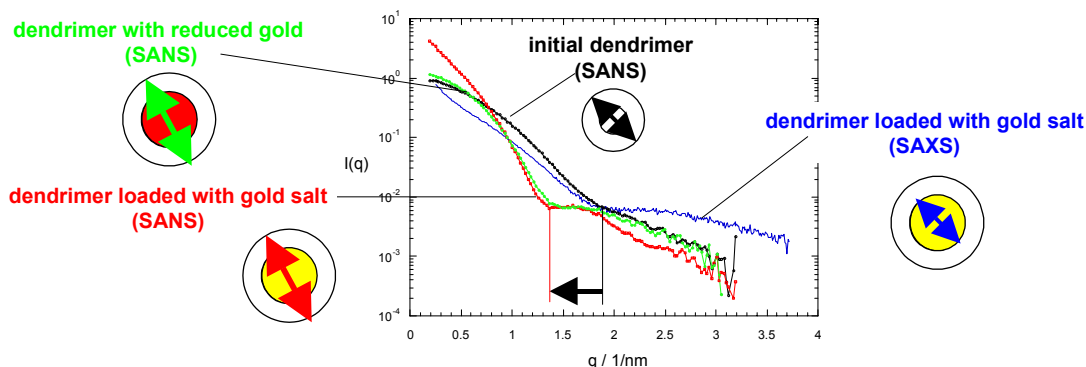
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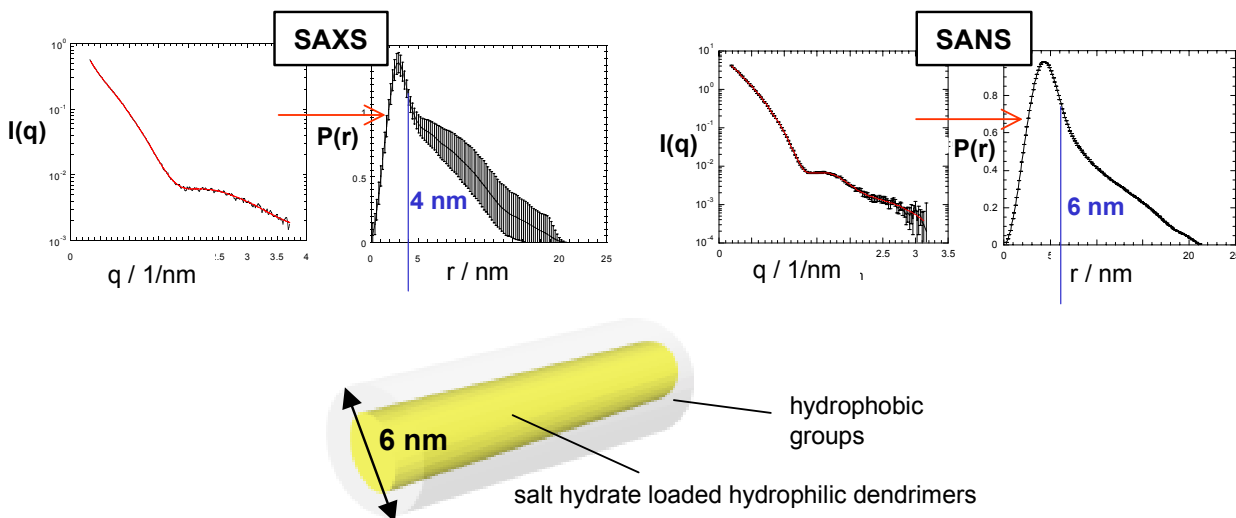
Beamline(s): X27C

**Introduction:** Higher generation dendrimers in solution can be approximated as homogeneous spheres, but there is sufficient space available inside the dendrimer molecule that allows them to serve as a “host” for smaller guest molecules. Amphiphilic dendrimers act as a nanoenvironment similar to that encountered in micelles or inverse micelles, solubilizing the guest in a solvent of different polarity. Here, we are interested in characterizing the nanoscale structure of dendrimers that act like inverse micelles.

**Results:** We use dendrimers with a hydrophilic poly(propylene imine) core that have been modified with hydrophobic chains attached to the dendrimer terminal groups and investigate how the structure changes when filled with a gold salt hydrate  $\text{HAuCl}_4 \cdot 3\text{H}_2\text{O}$  in toluene solution. The use of the gold salt hydrate not only allows for the addition of a well defined amount of salt and water, but also for a study of the structure by scattering techniques. The water provides contrast for a small angle neutron scattering (SANS) experiment when using deuterated solvent, and the gold can provide contrast for a complementary small angle x-ray scattering (SAXS) experiment.



**Figure 1.** SANS and SAXS data for hydrophobically modified dendrimers being filled with gold salt hydrate. Cartoons indicate what is measured in the different experiments.



**Figure 2.** Fourier Transformation (program ITP, Otto Glatter) of SAXS and SANS data reveals a cylindrical structure

While the initial dendrimers have a spherical structure with a collapsed core, solubilization of metal salt hydrate leads to the formation of cylindrical multi-dendrimer structures with swollen, metal-salt filled dendrimer cores. The cylindrical structure can be deduced from SAXS and SANS pair distance distribution functions  $P(r)$ .

Gold salt inside the dendrimers was reduced to form colloidal particles. Upon reduction, the cylindrical structure breaks up and spherical colloids are formed.

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